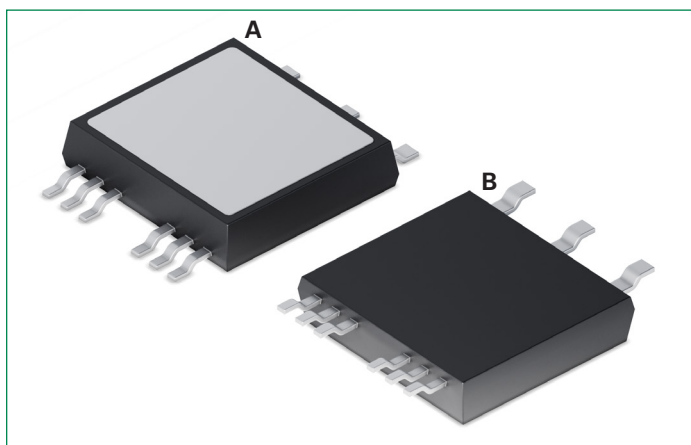


MCL10P1200LB

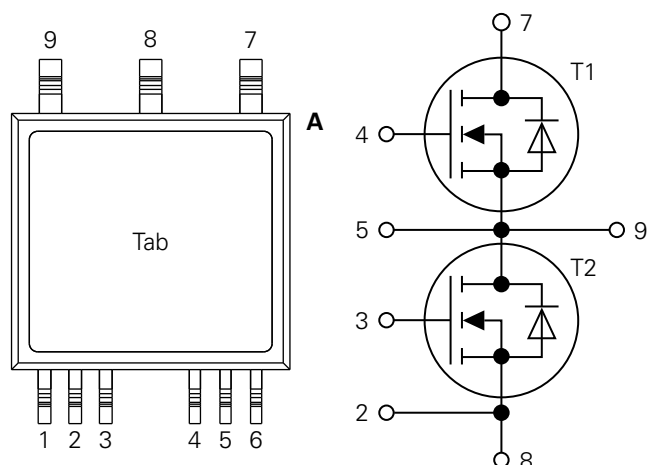
1200 V, 160 mΩ, 19.5 A SiC Power MOSFET in Phase-Leg Configuration

 E72873 Pending



A: Top, **B:** Bottom

Pinout Diagram (SMPD-B)



1: Not Connected; **2:** Kelvin Source T2; **3:** Gate T2; **4:** Gate T1;
5: Kelvin Source T1; **6:** Not Connected; **7:** DC+; **8:** DC-; **9:** Output;

Tab: Electrically Isolated

Features & Benefits:

- High speed switching with low capacitances
- High blocking voltage with low $R_{DS(on)}$
- Easy to parallel and simple to drive
- Resistant to latch-up

SMPD Package:

- DCB based isolated package improves thermal resistance and power handling capability
- Isolation voltage 2500V AC (RMS), 1 minute
- Low drain-to-tab stray capacitance
- Optimized package with separate driver source pin
- Advanced topside cooled packaging simplifies thermal management
- RoHS compliant
- Epoxy meets UL 94V-0

Applications:

- Solar Inverters
- High Voltage DC/DC converters
- Motor Drives
- Switch Mode Power Supplies
- UPS
- Battery Chargers
- Induction Heating

Product Summary

Characteristic	Value	Unit
I_{D25}	19.5	A
V_{DSS}	1200	V
$R_{DS(on)typ}$	160	mΩ

MOSFET Characteristics

Symbol	Characteristics	Conditions		Ratings			Unit	
				Min.	Typ.	Max.		
BV _{DSS}	Drain-Source Breakdown Voltage	I _D = 100 μA		1200	–	–	V	
I _{D25}	Drain Current	V _{GS} = 20 V	T _C = 25°C	–	–	19.5	A	
I _{D80}			T _C = 80°C	–	–	15		
I _{D100}			T _C = 100°C	–	–	13.5		
V _{GS}	Gate-Source Voltage	Continuous	T _{VJ} = 25°C	–30	–	30	V	
		Transient		–5	–	+20		
V _{GS(th)}	Gate Threshold Voltage	I _D = 5 mA, V _{GS} = V _{DS}	T _{VJ} = 25°C	1.8	2.8	4.0	V	
			T _{VJ} = 175°C	–	1.8	–		
T _{VJ,op}	Virtual Junction Temperature	–		–55	–	150	°C	
I _{DSS}	Drain-Source Leakage Current	V _{DS} = 1200 V, V _{GS} = 0 V	T _{VJ} = 25°C	–	1	100	μA	
			T _{VJ} = 175°C	–	1	–		
I _{GSS}	Gate-Source Leakage Current	V _{DS} = 0 V, V _{GS} = 22 V	T _{VJ} = 25°C	–	–	100	nA	
		V _{GS} = –6 V	T _{VJ} = 25°C	–	–	100		
R _{DS(on)}	Drain-Source On-State Resistance	I _D = 10 A, V _{GS} = 20 V	T _{VJ} = 25°C	–	160	200	mΩ	
			T _{VJ} = 175°C	–	230	–		
R _{G(int)}	Internal Gate Resistance	f = 1 MHz, V _{AC} = 25 mV, ESR of C _{iss}		–	0.85	–	Ω	
C _{iss}	Input Capacitance	V _{DS} = 800 V, V _{GS} = 0 V, f = 1 MHz	T _{VJ} = 25°C	–	890	–	pF	
C _{oss}	Output Capacitance			–	45	–		
C _{rss}	Reverse Transfer (Miller) Capacitance			–	5	–		
E _{oss}	C _{OSS} stored energy			–	14	–	μJ	
Q _g	Total Gate Charge	V _{DS} = 800 V, I _D = 10 A, V _{GS} = –5/20 V	T _{VJ} = 25°C	–	50	–	nC	
Q _{gs}	Gate Source Charge			–	15	–		
Q _{gd}	Gate Drain (Miller) Charge			–	17	–		
t _{d(on)}	Turn-on Delay Time	Inductive Switching Free Wheeling Diode: Body Diode V _{GS} = –5 V, V _{DS} = 800 V, I _D = 10 A V _{GS} = –5/20 V, R _{G(ext)} = 18 Ω	T _{VJ} = 25°C	–	9.4	–	ns	
			T _{VJ} = 150°C	–	8.7	–		
t _r	Current Rise Time		T _{VJ} = 25°C	–	4	–	ns	
			T _{VJ} = 150°C	–	3.1	–		
t _{d(off)}	Turn-off Delay Time		T _{VJ} = 25°C	–	24.5	–	ns	
			T _{VJ} = 150°C	–	30.2	–		
t _f	Current Fall Time		T _{VJ} = 25°C	–	31	–	ns	
			T _{VJ} = 150°C	–	31.8	–		
E _{on}	Turn-on Energy per Pulse		T _{VJ} = 25°C	–	310	–	μJ	
			T _{VJ} = 150°C	–	405	–		
E _{off}	Turn-off Energy per Pulse		T _{VJ} = 25°C	–	19.7	–	μJ	
			T _{VJ} = 150°C	–	22.7	–		
R _{th, JC}	Thermal Resistance, junction-to-case		–		–	–	1.4	K/W
R _{th, JS}	Thermal Resistance, junction-to-sink		per MOSFET with heatsink compound λ = 0.67 W/mK		–	2.2	–	K/W

Source-Drain Diode of MOSFET Characteristics

Symbol	Characteristics	Conditions		Ratings			Unit	
				Min.	Typ.	Max.		
V _{SD}	Forward Voltage Drop	I _F = 5 A, V _{GS} = -5 V	T _{VJ} = 25°C	–	4.2	–	V	
			T _{VJ} = 175°C	–	3.7	–		
t _{rr}	Reverse Recovery Time	V _{GS} = -5 V, I _F = 10 A, V _R = 800 V, MOSFET gate drive: V _{GS} = -5/20 V, R _G = 18 Ω (external)	T _{VJ} = 25°C	–	11.9	–	ns	
			T _{VJ} = 150°C	–	18.2	–		
Q _{rr}	Reverse Recovery Charge		T _{VJ} = 25°C	–	182	–	nC	
			T _{VJ} = 150°C	–	334	–		
I _{rr}	Max. Reverse Recovery Current		T _{VJ} = 25°C	–	14.7	–	A	
			T _{VJ} = 150°C	–	20.5	–		
dI _F /dt	Current Slew Rate		T _{VJ} = 25°C	–	2320	–	A/μs	
			T _{VJ} = 150°C	–	2840	–		
E _{rec(off)}	Turn-off Energy of Intrinsic Diode per Pulse		T _{VJ} = 25°C	–	50.6	–	μJ	
			T _{VJ} = 150°C	–	69.0	–		

SMPD Package

Symbol	Characteristics	Conditions		Value			Unit
				Min.	Typ.	Max.	
I _{RMS}	RMS Current	Wide Terminal		–	–	100	A
		Standard Terminal		–	–	60	
T _{stg}	Storage Temperature	–		–55	–	150	°C
T _{op}	Operation Temperature	–		–55	–	150	
F _C	Mounting Force with Clip	–		40	–	130	N
d _{Spp/App} d _{Spb/Apb}	Creepage Distance on Surface / Clearance Distance Through Air	Terminal to Terminal	Between Pin 1 to 3	1.6	–	–	mm
			Between Pin 4 to 6				
			Between Pin 3 to 4	6.8	–	–	mm
			Between Pin 7 to 9				
	Clearance Distance Through Air	Terminal to Backside Plane	For All Terminals	4	–	–	mm
	Creepage Distance on Surface	Terminal to Backside Tab		5.17	–	–	mm
V _{ISOL}	Isolation Voltage	50/60 Hz; RMS; I _{ISOL} < 1 mA, t = 1 second		–	3000	–	V
		50/60 Hz; RMS; I _{ISOL} < 1 mA, t = 1 minute		–	2500	–	
W	Weight	–		–	8	–	g

Characteristic Curves

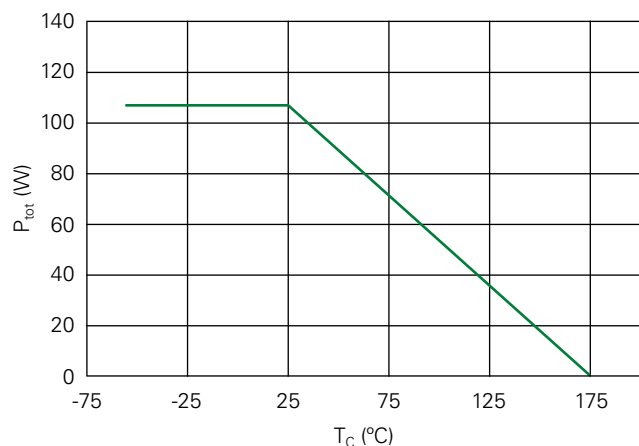
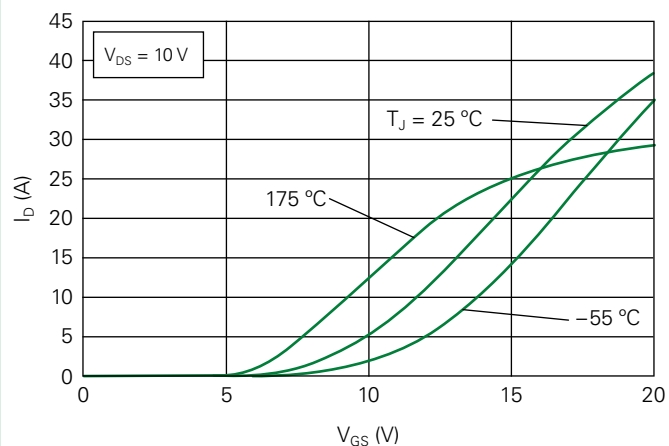
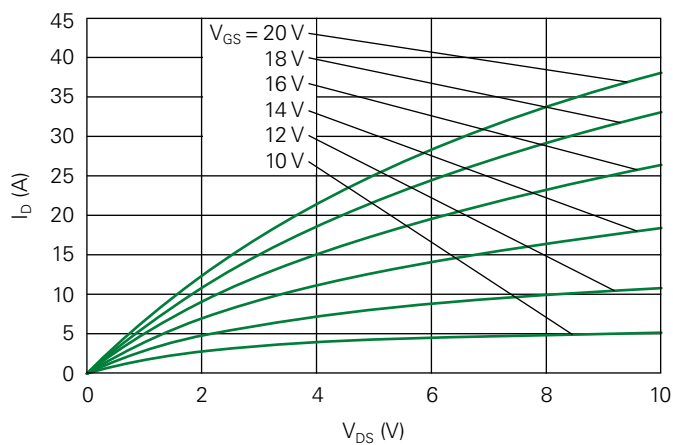
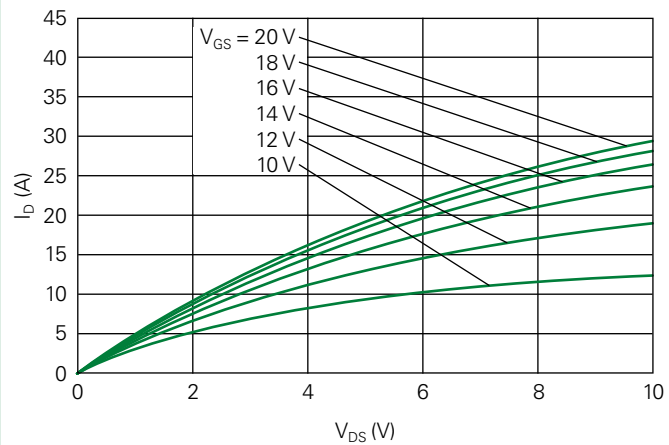
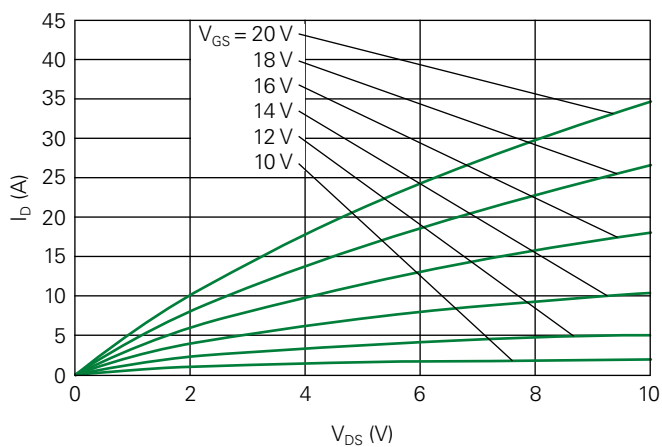
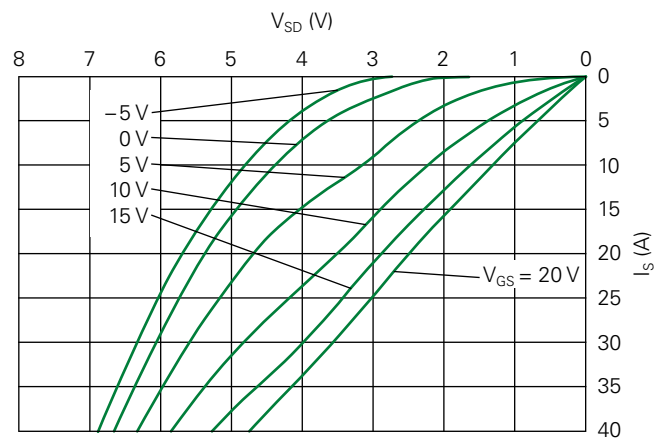
Fig.1. Maximum Power Dissipation ($T_{VJ} = 175\text{ }^{\circ}\text{C}$)

Fig. 2. Typical Transfer Characteristics

Fig. 3. Typical Output Characteristics ($T_{VJ} = 25\text{ }^{\circ}\text{C}$)Fig. 4. Typical Output Characteristics ($T_{VJ} = 175\text{ }^{\circ}\text{C}$)Fig. 5. Typical Output Characteristics ($T_{VJ} = -55\text{ }^{\circ}\text{C}$)Fig. 6. Typical Reverse Conduction Characteristics ($T_{VJ} = 25\text{ }^{\circ}\text{C}$)

Characteristic Curves

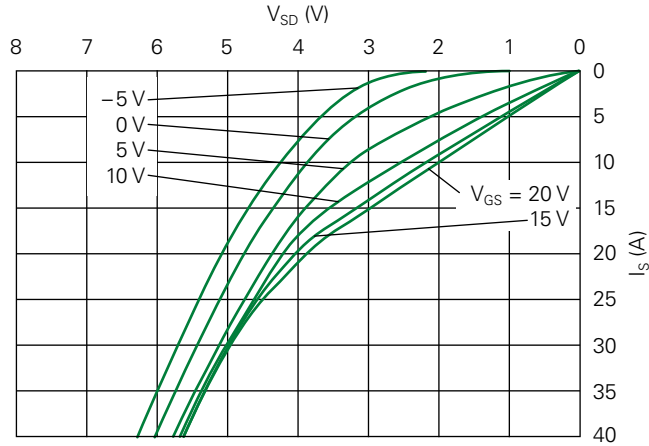
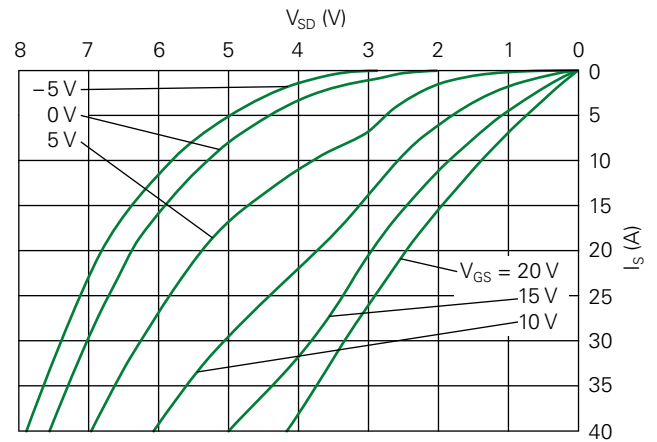
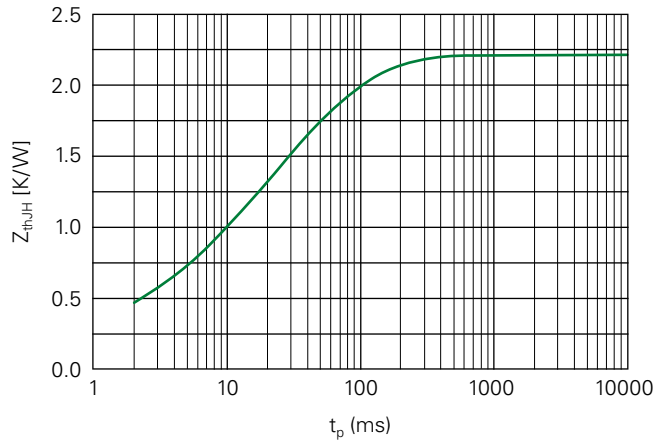
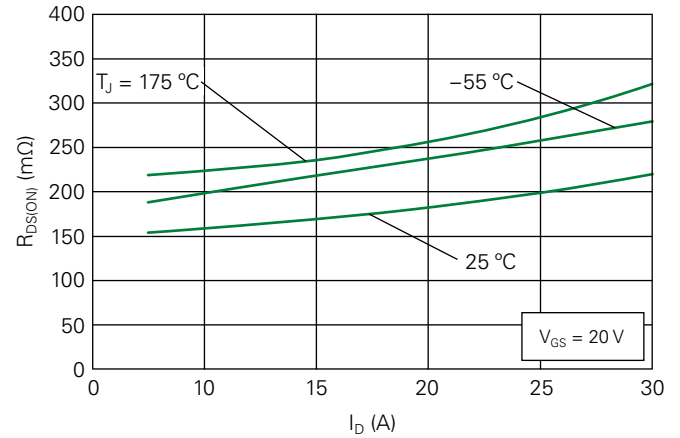
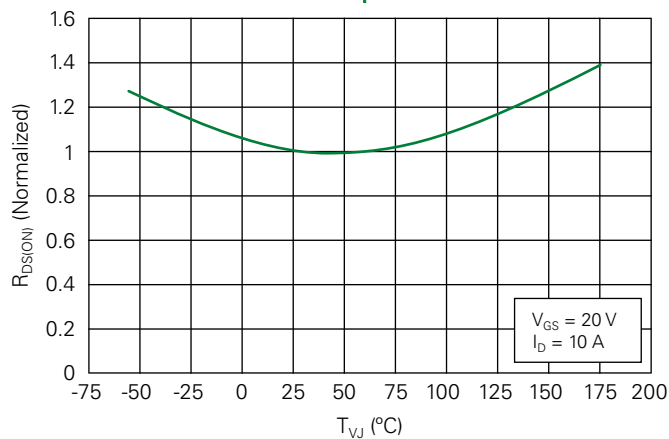
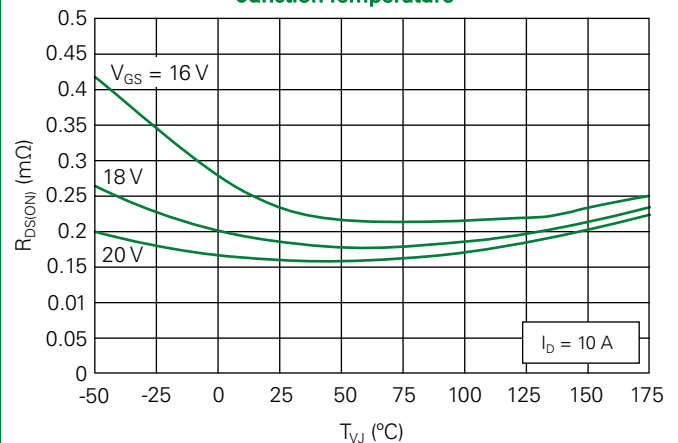
Fig. 7. Typical Reverse Conduction Characteristics ($T_{VJ} = 175^\circ\text{C}$)Fig. 8. Typical Reverse Conduction Characteristics ($T_{VJ} = -55^\circ\text{C}$)Fig. 9. Typical Transient Thermal Response
Junction to Heat SinkFig. 10. Drain-Source On-State Resistance vs.
Drain CurrentFig. 11. Normalized On-State Resistance vs.
Junction TemperatureFig. 12. Typical On-State Resistance vs.
Junction Temperature

Fig. 13. Typical Threshold Voltage

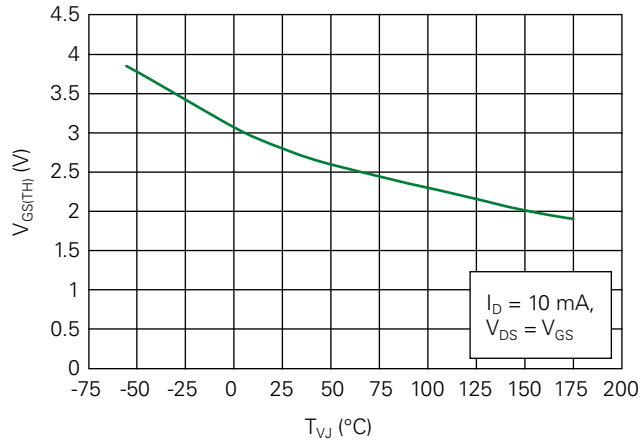


Fig. 14. Typical Junction Capacitance up to 1000 V

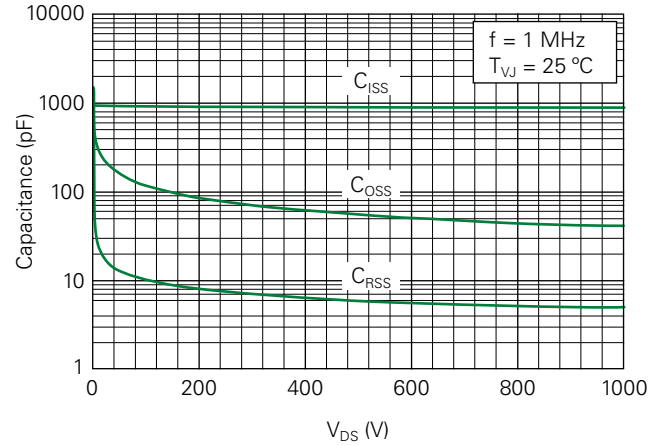


Fig. 15. Typical Junction Capacitance up to 200 V

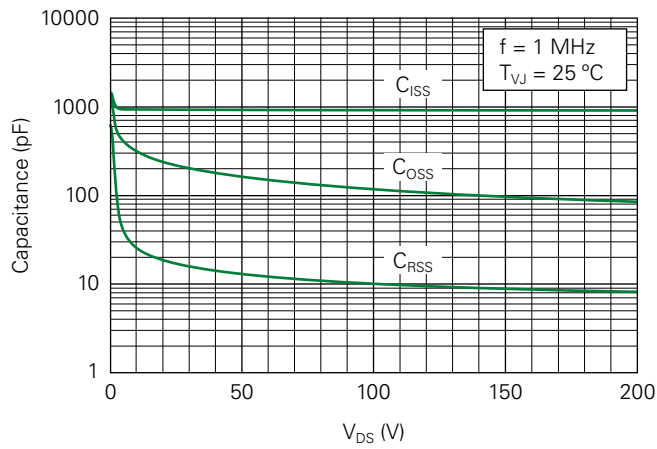
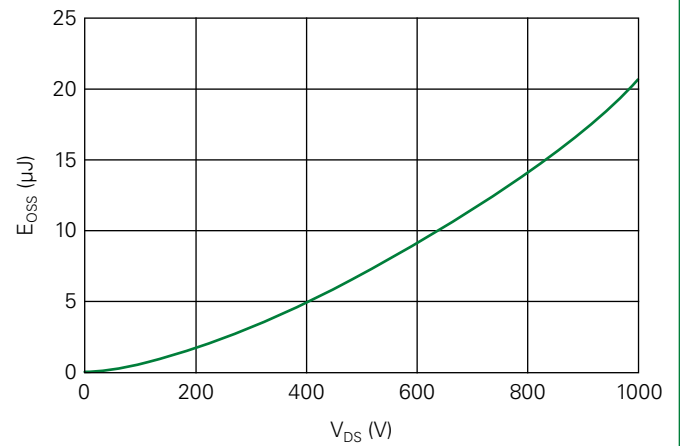
Fig. 16. Typical C_{OSS} Stored Energy E_{OSS} 

Fig. 17. Typical Switching Energy at 25 °C vs. Drain Current

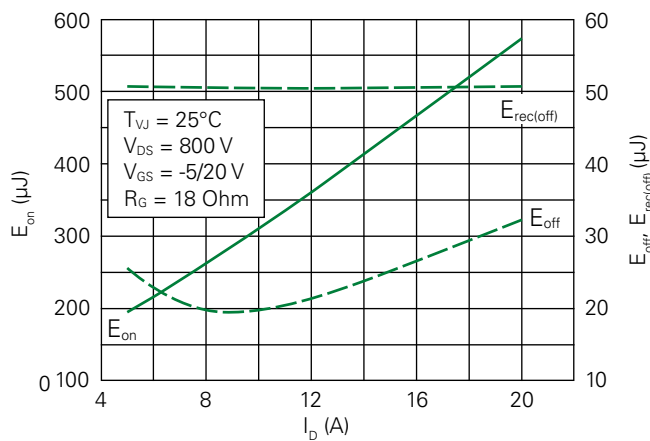


Fig. 18. Typical Switching Energy at 150 °C vs. Drain Current

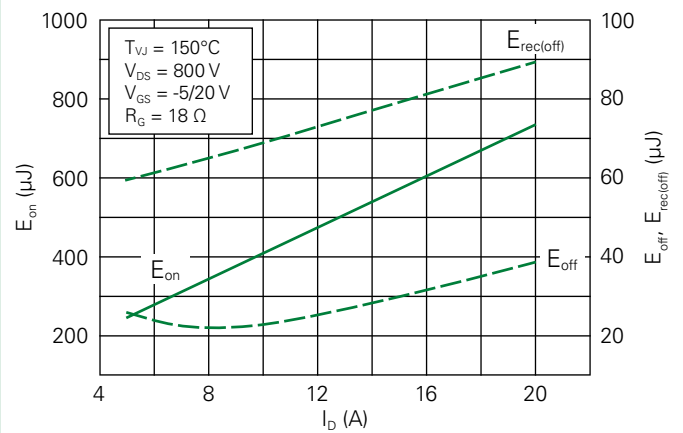


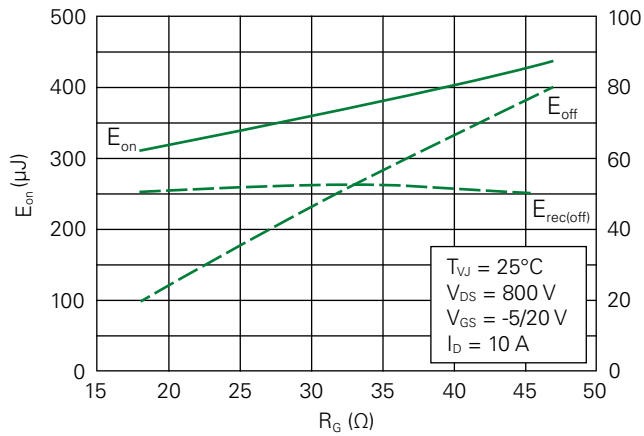
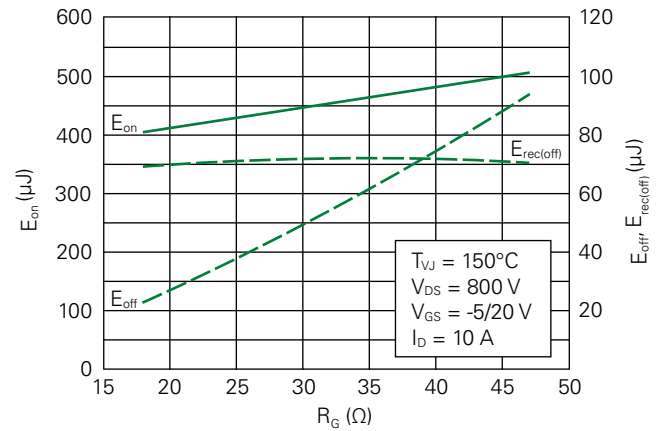
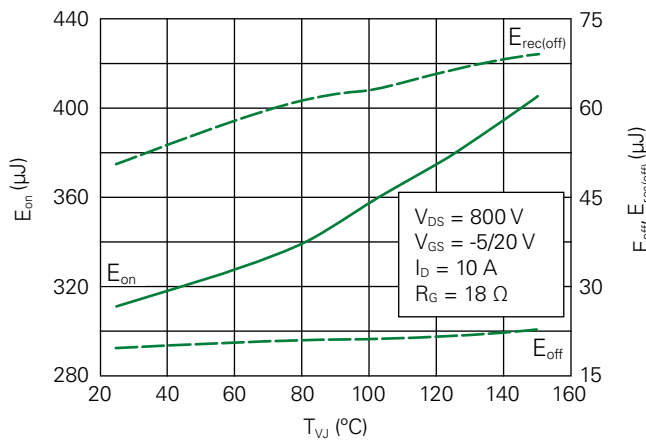
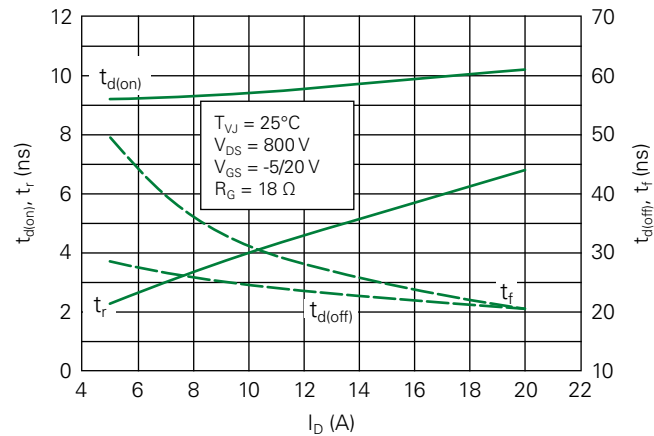
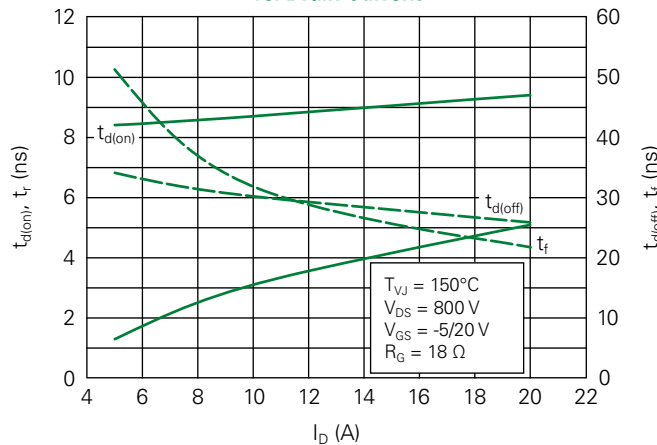
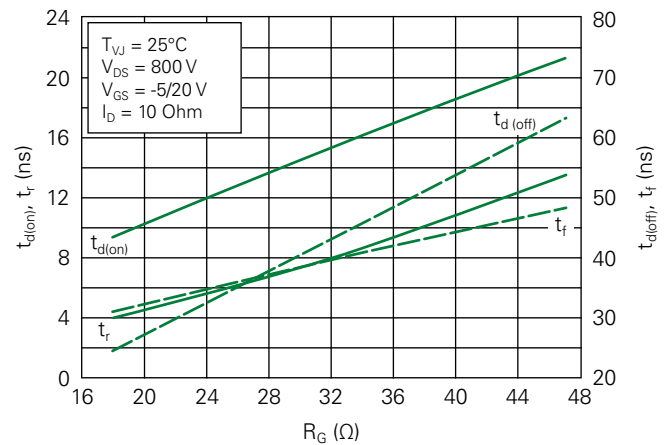
Fig. 19. Typical Switching Energy at 25 °C vs. External Gate Resistor**Fig. 20. Typical Switching Energy at 150 °C vs. External Gate Resistor****Fig. 21. Typical Switching Energy vs. Temperature****Fig. 22. Typical Switching Times at 25 °C vs. Drain Current****Fig. 23. Typical Switching Times at 150 °C vs. Drain Current****Fig. 24. Typical Switching Times at 25 °C vs. External Gate Resistor**

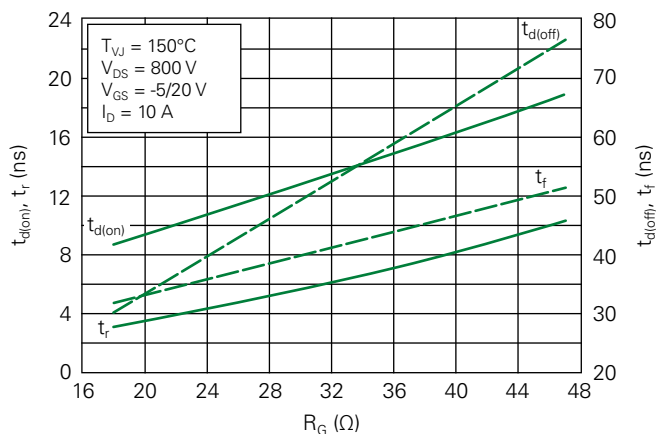
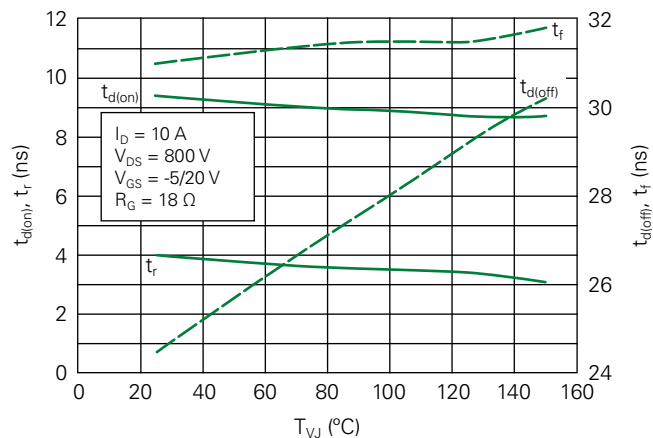
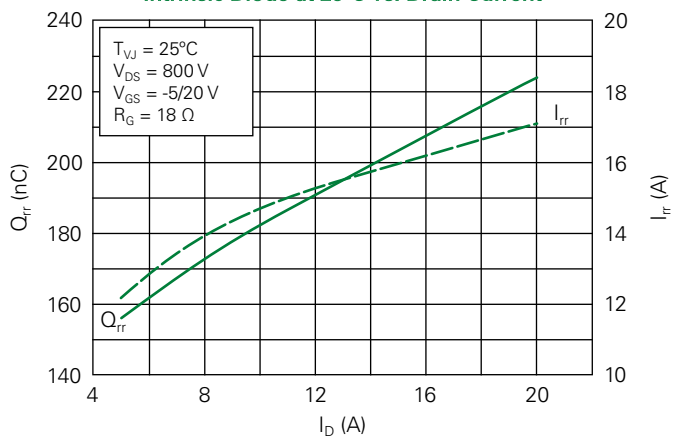
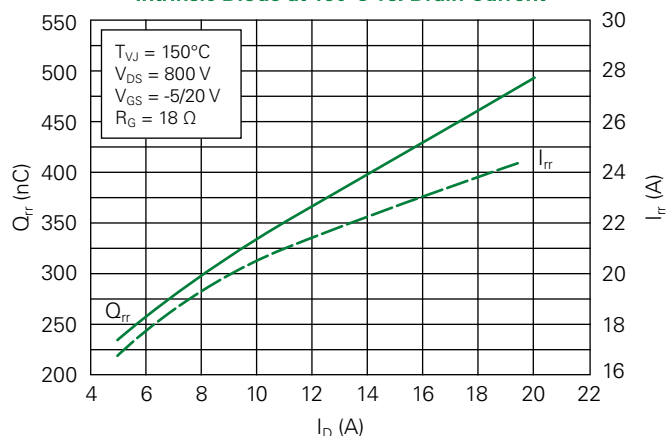
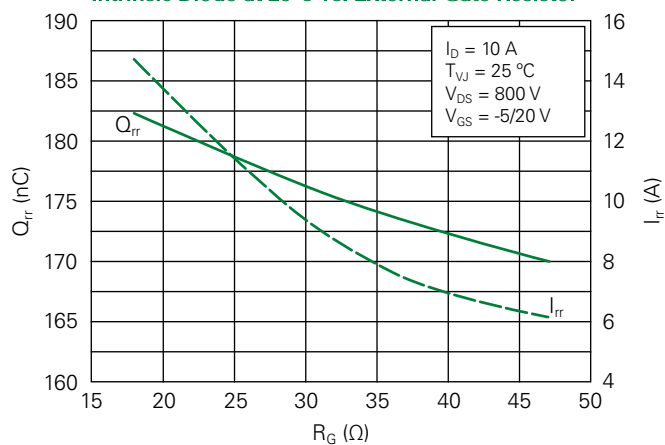
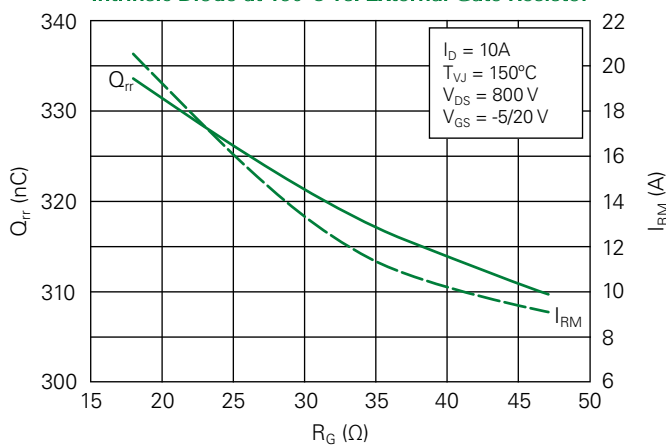
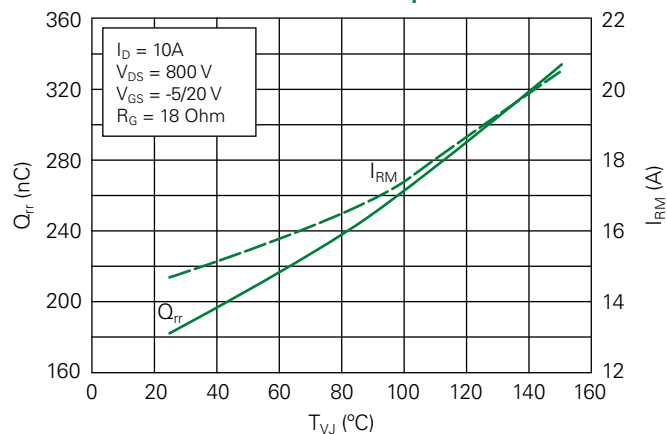
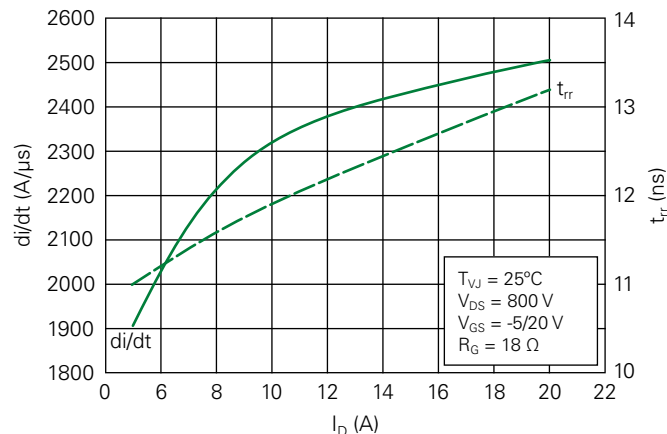
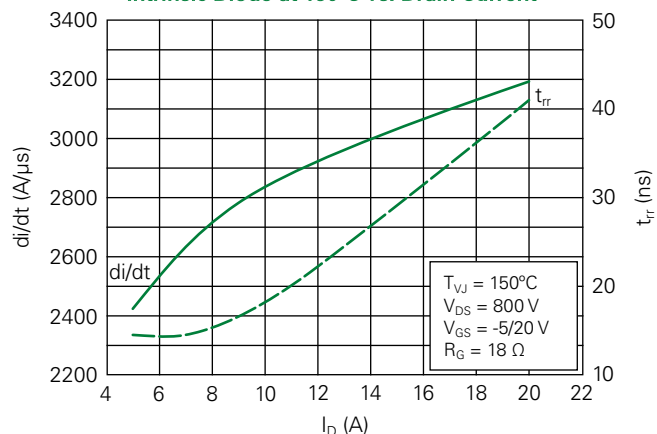
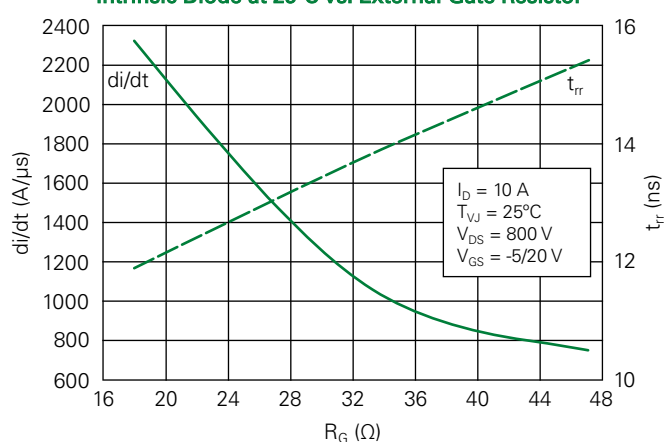
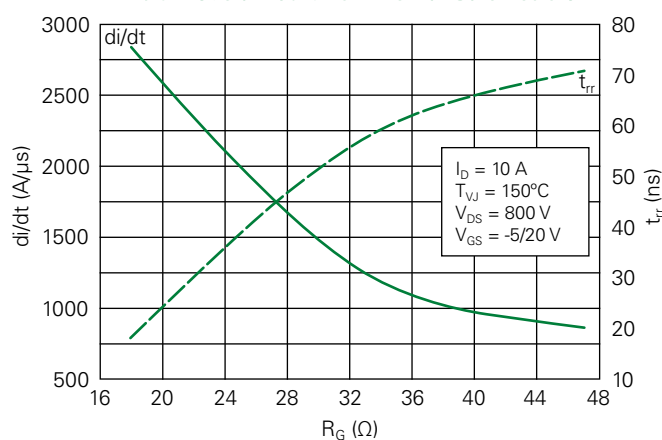
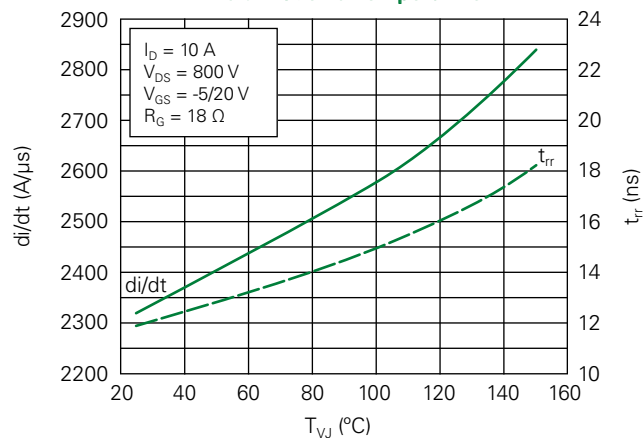
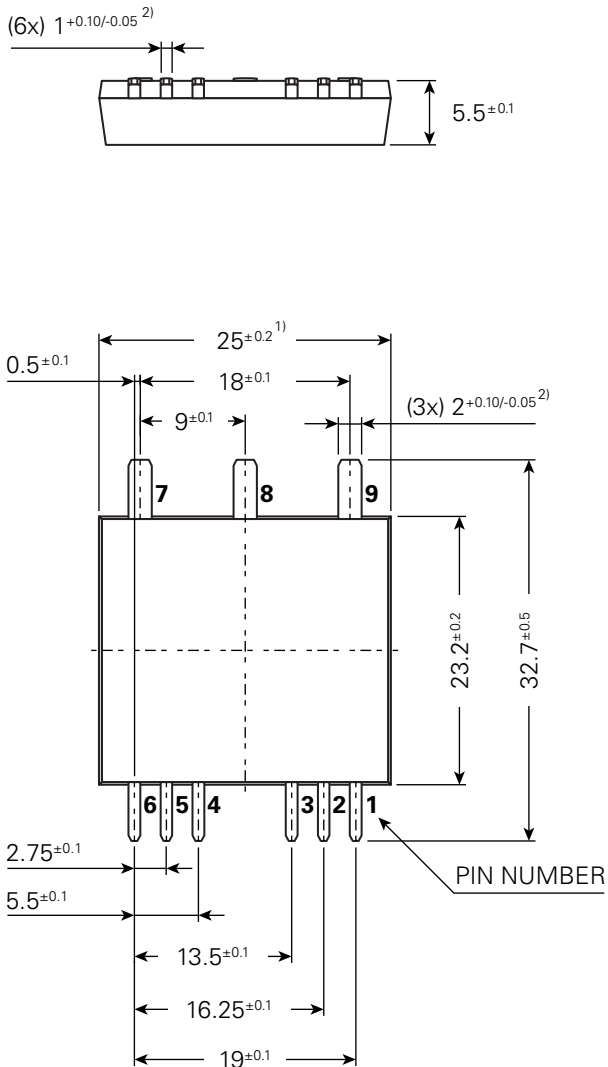
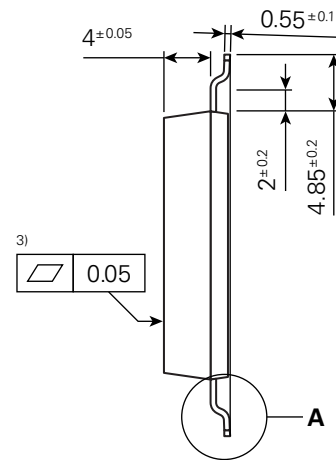
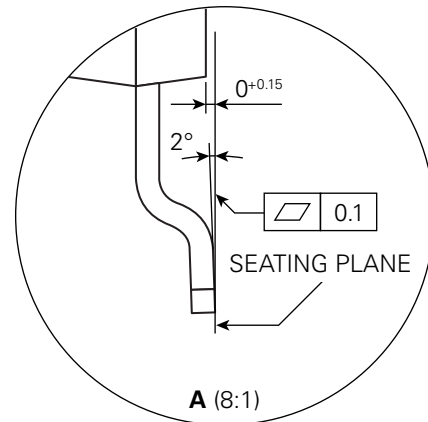
Fig. 25. Typical Switching Times at 150°C vs. External Gate Resistor**Fig. 26. Typical Switching Times vs. Temperature****Fig. 27. Typical Reverse Recovery Characteristic of Intrinsic Diode at 25°C vs. Drain Current****Fig. 28. Typical Reverse Recovery Characteristic of Intrinsic Diode at 150°C vs. Drain Current****Fig. 29. Typical Reverse Recovery Characteristic of Intrinsic Diode at 25°C vs. External Gate Resistor****Fig. 30. Typical Reverse Recovery Characteristic of Intrinsic Diode at 150°C vs. External Gate Resistor**

Fig. 31. Typical Reverse Recovery Characteristic of Intrinsic Diode vs. Temperature**Fig. 32. Typical Reverse Recovery Characteristic of Intrinsic Diode at 25°C vs. Drain Current****Fig. 33. Typical Reverse Recovery Characteristic of Intrinsic Diode at 150°C vs. Drain Current****Fig. 34. Typical Reverse Recovery Characteristic of Intrinsic Diode at 25°C vs. External Gate Resistor****Fig. 35. Typical Reverse Recovery Characteristic of Intrinsic Diode at 150°C vs. External Gate Resistor****Fig. 36. Typical Reverse Recovery Characteristic of Intrinsic Diode vs. Temperature**

Part Outline Drawing

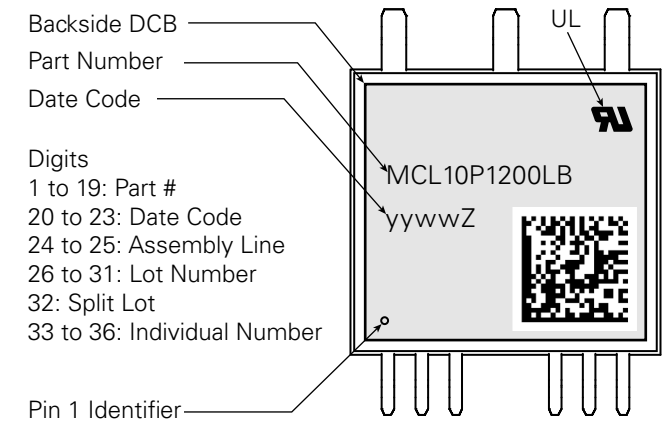


Dimensions in mm (1 mm = 0.0394")

**NOTES:**

1. Protrusion may add 0.2 mm max. on each side
2. Additional max. 0.05 mm per side by punching misalignment or overlap of dam bar or bending compression
3. DCB AREA 10 to 50 μm convex; position of DCB area in relation to plastic rim: $\pm 25 \mu\text{m}$ (measured 2 mm from Cu rim)
4. Terminal plating: 2 - 6 μm Ni + 10 - 25 μm Sn (galv.) cutting edges may be partially free of plating

Part Number and Marking



M = MOSFET
C = SiC MOSFET
L = Monolith Gen 1
10 = Current Rating [A]
P = Phase Leg
1200 = Reverse Voltage [V]
LB = SMPD-B
yy = Year
ww = Work Week
Z = Location

Ordering Information

Ordering	Part Number	Marking on Product	Delivering Mode	Base Quantity	Ordering Code
Standard	MCL10P1200LB-TUB	MCL10P1200LB	Tube	20	MCL10P1200LB-TUB
Alternative	MCL10P1200LB-TRR	MCL10P1200LB	Tape & Reel	200	MCL10P1200LB-TRR

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